

## The case of a cyclist and tractor traffic accident

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**ABSTRACT :** *When assessing the cause of a traffic accident, it is also necessary for the technical expert to take into account the real influences that affect individual participants. This is especially important for accidents in which one of the participants is cyclist. Technical expert must consider all the circumstances necessary to assess the cyclist's behavior. Negligible is not even the age of a cyclist, since in the case of a child or an old man the driver overtaking bicycle should take this into consideration. The article deals with case of traffic accident between tractor with the trailer and a bicycle which was riding by cyclist at the age of 80. Apart from the described procedure by expert in the calculations, the influences on participants' behavior are also discussed.*

**KEY WORDS:** *Tractor with trailer, cyclist, bicycle, accident, analysis, characteristics of influences*

### I. INTRODUCTION

In the technical analysis of traffic accidents, for the technical expert's determination of said accident cause, it is necessary to know not only the actual course of the accident but also to have a summary of the knowledge, for example, in the field of vision, in the field of psychological aspects, etc., which influence the behavior of the participants. These influences are also significant in traffic accidents with cyclists who, while on the road, have specific conditions including: way of driving, sight orientation, different stability of the bicycle at different speeds. The most endangered groups are children and older people. Reported casuistry concerns an 80-year-old cyclist who has hit a tractor trailer trailed by the Perard Interbenne tractor at a time when he was overtaken by latter one. The driver of the tractor considered that due to the fact that the cyclist had hit the trailer, he could not bear responsibility for the accident. On the contrary, cyclist was of the opinion that trailer had come into contact with him and therefore did not feel responsible for the accident. The police have therefore called for the cause of a road accident to be identified by a technical expert, whom procedure is described below as well as his assessment of the situation.

### II. RECORDS

- A. Survey of the traffic accident site by the police where it was intended: where the tractor with trailer was located after the traffic accident and where there were blood trails on the road - Fig. 1



Fig. 1: Showing measured tracks and positionsions at the traffic accident site

B. Photo documentation of traffic accident site made by police - Fig. 2



Fig. 2 Showing photo documentation made by police at the traffic accident site

### III. TRACTOR TRAILER AND BICYCLE DAMAGE ANALYSIS

trailer

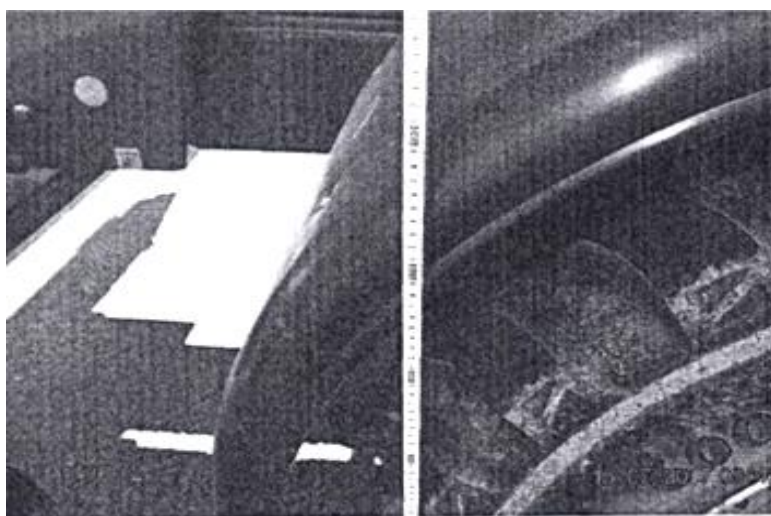


Fig.3 Showing damage to the right rear fender of the trailer

damaged right rear fender

Damage in height of 1.0

**Bicycle :** damage unreported, height 1.0 m

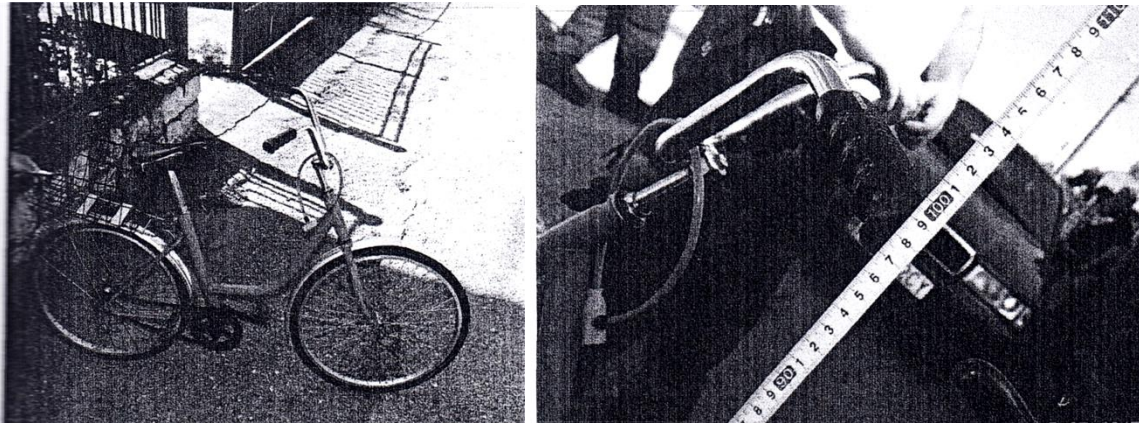


Fig. 4 Showing bicycle and height of its handlebars

#### IV. THE RESULT OF CALCULATED MOVEMENT OF THE BICYCLE AND TRACTOR ROAD TRAIN IN PC CRASH SIMULATION PROGRAM

It was found by calculation that at the time of the collision, trailer was moving at a speed of 18.0 mph, and the bicycle was moving at a speed of 9.0 mph with its motion pointing to the left, and as a result of the impact of its front wheel on the tire of the trailer, there was a turn of its control to the right, while handlebars crashed into the trailer's fender, and bicycle and cyclist fell on the road - fig.5,6.

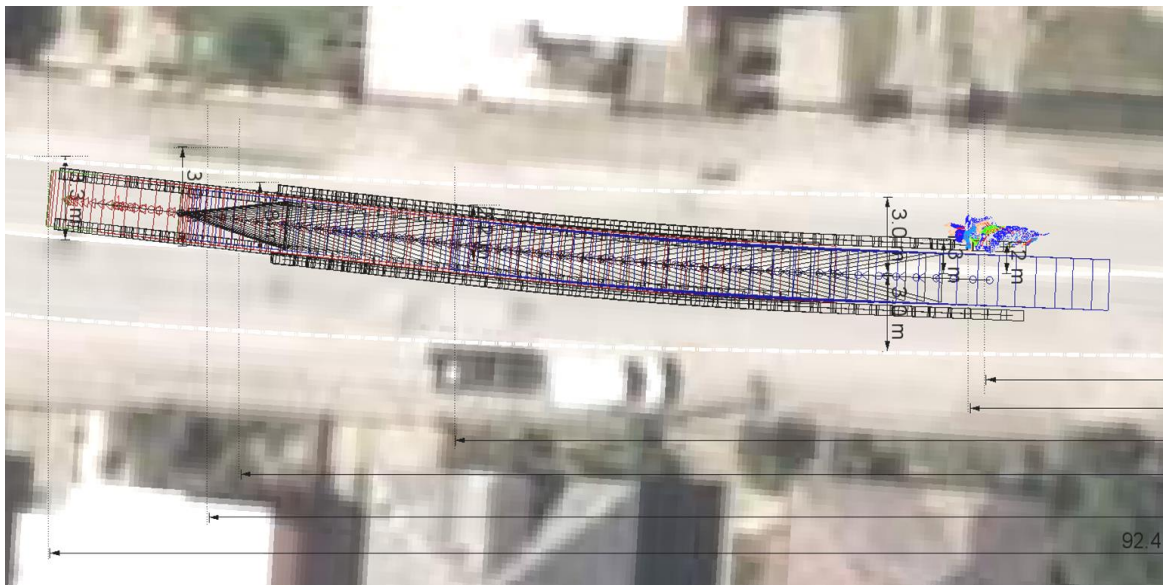
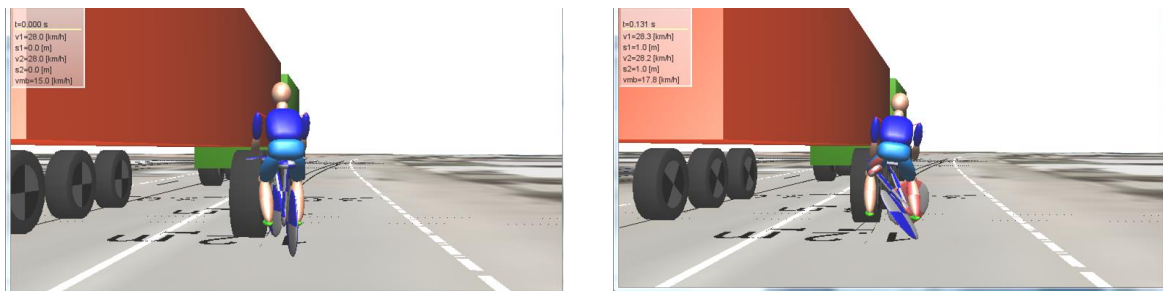


Fig. 5 Showing motion of tractor with trailer and bicycle as calculated in the plan view



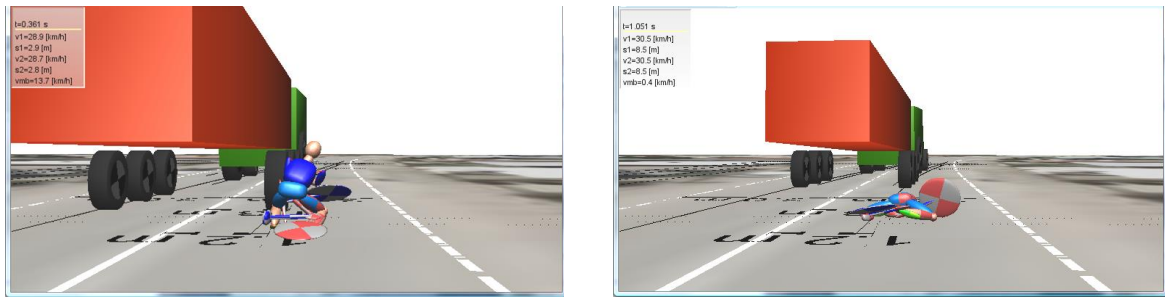


Fig. 6 Showing motion of tractor with trailer and bicycle in 3D calculation

Subsequently, a calculation of the tractor with trailer and bicycle movement before their collision was made, whereby their distances, motion times and driving mode were determined. It was found that the tractor started overtaking the bicycle at the time 6.2 s before collision at a distance of 49.0 m before the crash site, and that, when overtaking, the road train (tractor with trailer) was moving from a bicycle with a lateral distance of 1.1 m - fig. 7, 8, 9, 10, 11

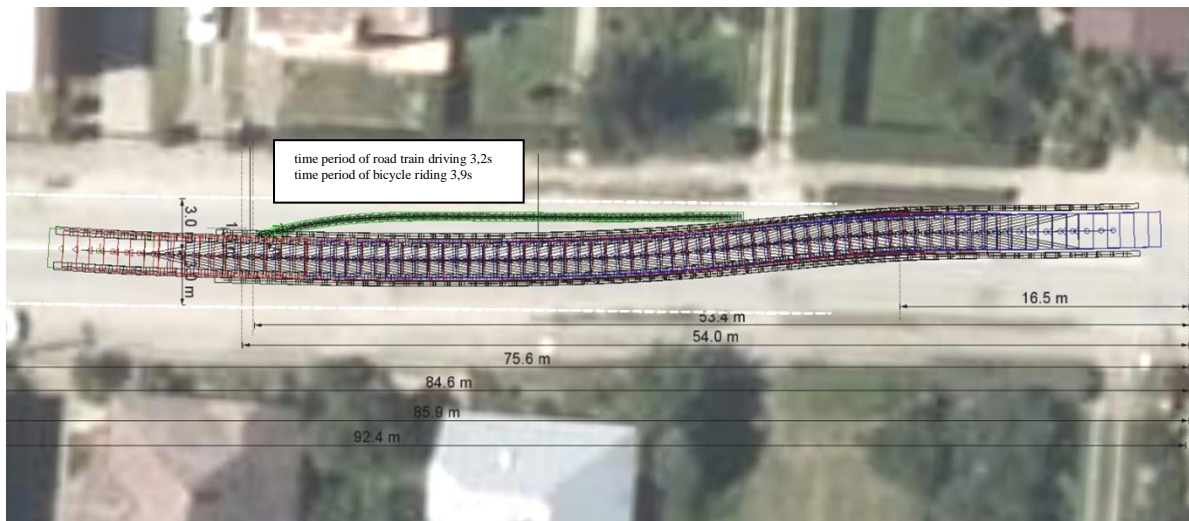


Fig. 7 Showing movement of a tractor with trailer and bicycle before collision according to the calculation

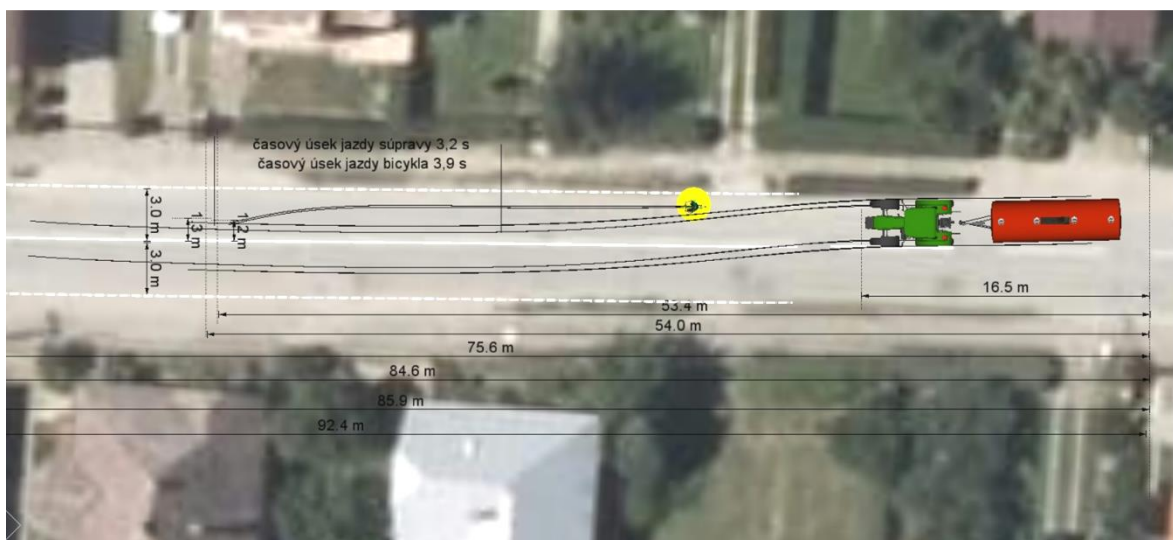


Fig. 8 Showing movement of a tractor with trailer and bicycle when the tractor started overtaking of bicycle

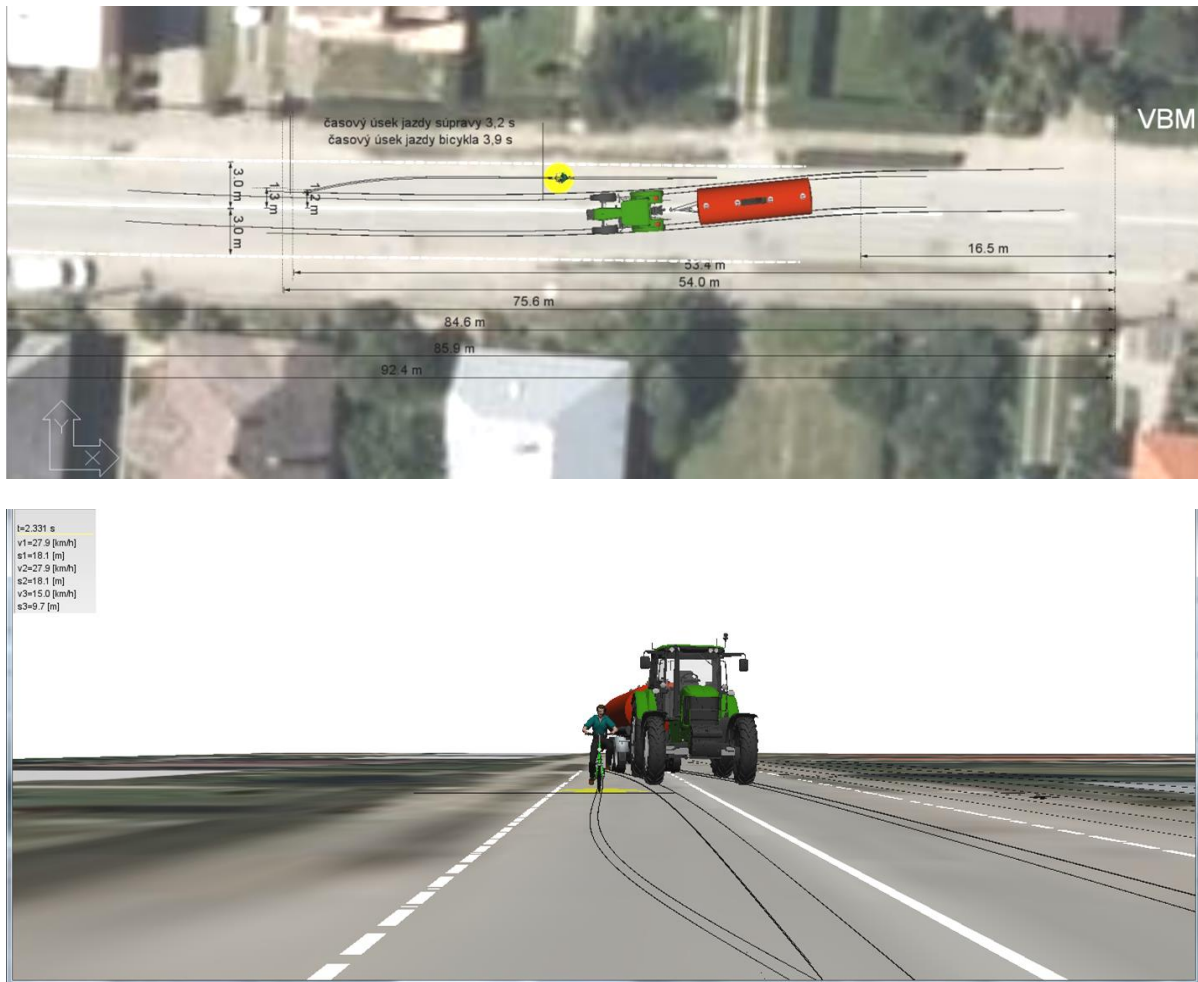


Fig. 9 Showing movement of a tractor with trailer and bicycle at the time when their simultaneous movement started

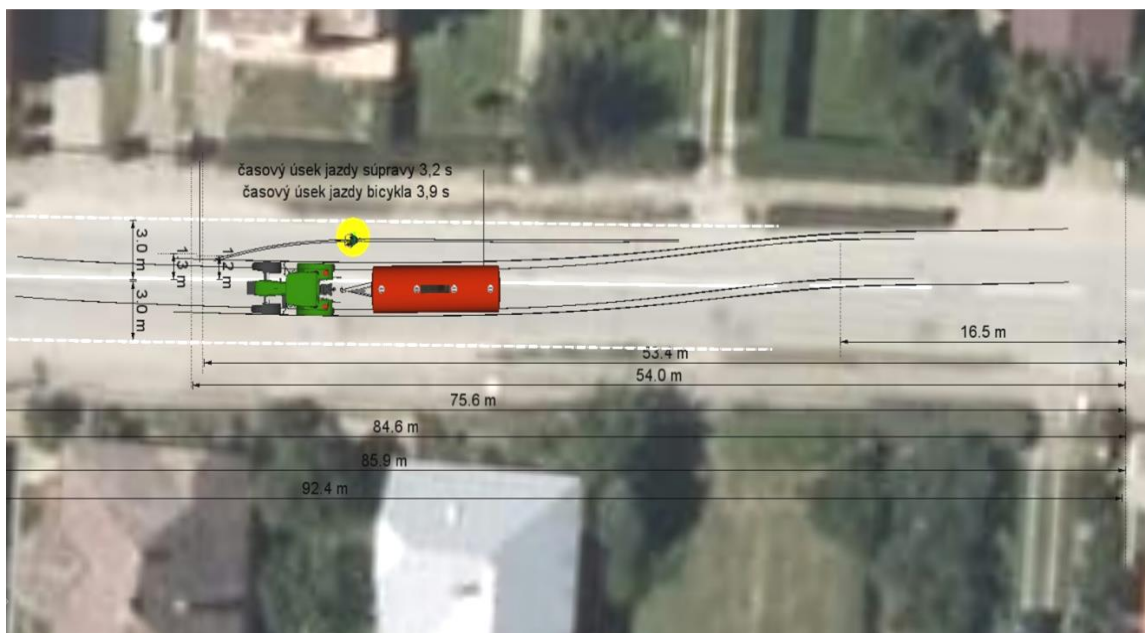


Fig. 10 Showing movement of a tractor with trailer and bicycle at the time when cyclist looked back



Fig. 11 Showing movement of a tractor with trailer and bicycle at the time whe bicycle crashed into the trailer

## V. DISCUSSION - ASSESSMENT OF INFUENCES

**For cyclists :** A very large role in cycling plays the so-called comfortable zone. It can be imagined as an imaginary traffic lane where the cyclist moves while riding on the road. This space ensures safe maneuvering in collision or unexpected situations. Every cyclist can perceive this distance quite differently. It is heavily influenced by the ability to cope with stress situations and riding skills. If this zone is disturbed by other road user, the consequences for all parties involved may be fatal. If the cyclist concerned does not feel safe, he or she may react in a very unexpected way with insufficient experience.

With such an unexpected reaction may react children or old people in particular. For overtaking by personal motor vehicle (vehicle length up to 5 m) applies, that the cycling movement consists of the so called microwaves and macrowaves. The trajectory - of macro wave, its wavelength, and amplitude can be affected by cyclist's own will. He called microwave the bicycle and its oscillation around the trajectory of motion and is influenced by the style of ride, terrain profile, pedaling frequency, surface roughness, or weather conditions. The size of the transverse deflection, as shown by research, is the sum of amplitude macro and microwaves and was determined by the range of experienced cyclists of 0.5 m and by less experienced cyclists and children of 1.5 m. The size of the transverse deflection is the sum of both sides of amplitudes from the motion axis when watching the ride ahead. Another significant increase is when a cyclist watches traffic in that moment, when he turns his head back. Experienced cyclists may increase this by 1 meter and less experienced cyclists by up to 2 meters. Another factor that also affects the size of microwaves amplitude is speed of a cyclist. When riding downhill, if the speed is more than 15 mph and without pedaling the micro deflections almost disappear, and the trajectory of motion is in this case characterized by a extending macro wave.

For a better orientation in the given issue, the following two terms need to be defined:

- a) Necessary lateral distance between cyclist and overtaking motor vehicle - this is the distance between overtaking vehicle and cyclist, in which the cyclist will not be at risk and at the same time feel no risk, that is, a distance where no danger arises, neither direct or of psychological reasons. This particular distance depends on trajectory of movement of the two passing road users, vehicle and cyclist and their aerodynamics (for higher speeds) and psychics.
- b) The safe lateral distance between cyclist and overtaking vehicle - is such a distance that will always be greater than the necessary lateral distance. It depends on the same factors as necessary distance, but here is added dependency on transverse relocation (e.g. looking back, avoiding an obstacle, get scared) and eventually fall of a cyclist.

For example, in Germany there is a minimum distance between a cyclist and a car determined from 1.5 to 2 meters. Also in France there is a distance of 1.5 meters established for a long time. In Austria, Portugal, a lateral distance of 1.5 meters is also set.

An important element is also the fact that a cyclist has to look on the road in front of the bicycle, which results from danger of a ride into the road hole or road irregularity that influences his behavior (inclined head - view on the road). Another important element is length of overtaking time, especially by riding simultaneous while overtaking. This time is significantly lower at personal vehicles than at trucks and buses, and road trains respectively. This time is also prolonged by small differences in speed between the bicycle and the vehicle or road train from 1 second to a few seconds, which also has a regular impact on the behavior of the cyclist (stress, effort to control the situation, e.g. the length of road train, etc.).

On the movement of the tractor-trailer with a length of 15.5 m

trailer does not respond to the steering of tractor but to changing direction of tractor's movement, i.e. it reacts late, which also applies to the alignment of road train after passing the curve, which requires a considerable amount of anticipation from the tractor driver.

In this case, it was about 90 m long straight section of the road between two turns - see view fig.12



Fig. 12 90 m long straight section of the road between two turns

where the roadsides were not marked and not straight, which caused the need for increased attention by the cyclist towards the road.

Those conditions should have been recognized and anticipated by both, cyclist and driver.

If driver decided to overtake the bicycle there were following restrictions for that:

- solid line in the road section
- limited view to the next curve (in case if vehicle comes in opposite direction, he had no real possibility of correcting the transverse position of road train when overtaking)
- length of the section on which he could have performed overtaking maneuver
- age and technical characteristics of the cyclist (80 y., Eska bicycle)
- relatively small difference in road train and bicycle speeds (19 mph - 9 mph)
- road train length (cyclist did not recognize the length of road train or did not have the chance to recognize whether he was overtaken by a solo tractor or a road train)

Driver had an opportunity to recognize and anticipate the above mentioned conditions in time prior to the commencement of overtaking.

**Driver :** would prevent the occurrence of a traffic accident when overtaking the bicycle if he took full account of the real limitations for this maneuver and if he readjusted the movement of the road train to that, i.e.

drove with a lateral distance of at least 2 m from a bicycle (due to the length of road train and the time of simultaneous ride). If he did not change the direction of tractor to the right side before the rear part of trailer passed the bicycle safely.

If he could not meet the above conditions, he should not overtake under the given circumstances.

**Cyclist :** would prevent the occurrence of a traffic accident if he did not turn his head in order to convince himself of the road train's length, which led to the formation of a macrowave pointing to the left side in movement of the bicycle.

## **VI. CONCLUSION**

The result of the situation's technical assessment corresponded to the description of tractor driver, but, having considered all the factors which had an impact on the tractor with trailer and the bicycle, was the cause of a traffic accident attributable to his mode of driving. It can be said that the tractor driver, among other things, had the opportunity to recognize that the cyclist is an old man and the way he was overtaking was in contradiction not only with the length of his road train but also with this fact.

## **VII. ACKNOWLEDGMENTS**

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